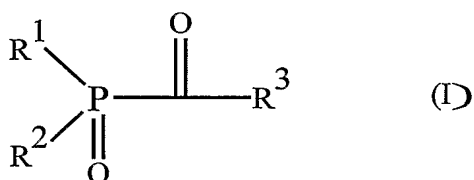


CLAIMS:

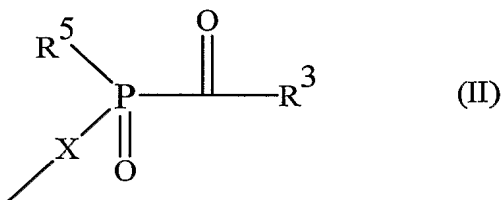
1. An energy curable intaglio printing ink, curing by free radical acrylate chemistry, and including a photoinitiator comprising an acylphosphine oxide, whereby the ink does not fluoresce in at least the visible light wavelength region when exposed to ultraviolet light.
2. A printing ink according to Claim 1, in which said acylphosphine oxide is a compound of formula (I):



in which:

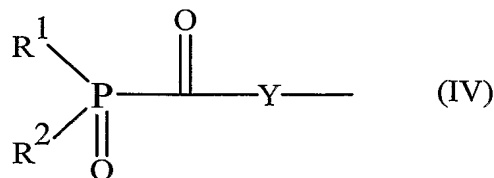
R^1 and R^2 are independently selected from $\text{C}_1 - \text{C}_{12}$ alkyl groups, $\text{C}_3 - \text{C}_7$ cycloalkyl groups, aryl groups, aralkyl groups, heterocyclic groups having from 3 to 7 ring atoms, of which at least one is a sulphur or nitrogen atom and groups of formula $-\text{COR}^3$;

or R^2 represents a group of formula $-\text{OR}^4$, where R^4 represents a $\text{C}_1 - \text{C}_6$ alkyl group, an aryl group, an aralkyl group or a cationic group or atom, or R^2 represents a group of formula (II):



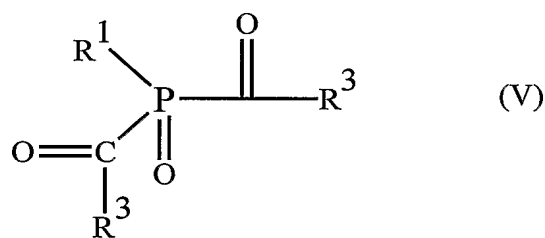
where X represents a $\text{C}_1 - \text{C}_{18}$ alkylene group or a biphenyldiyl group, and R^5 represents any of the groups represented by R^1 or a group of formula $-\text{OR}^4$; and

R³ represents a C₁ - C₆ alkyl group, an aryl group, a heterocyclic group having from 3 to 7 ring atoms, of which at least one is a sulphur or nitrogen atom, or a group of formula (IV):



where Y represents a C₁ - C₁₈ alkylene group a phenylene group, a cyclohexylene group or a biphenyldiyl group.

3. A printing ink according to Claim 2, in which said acylphosphine oxide is a compound of formula (V):



in which:

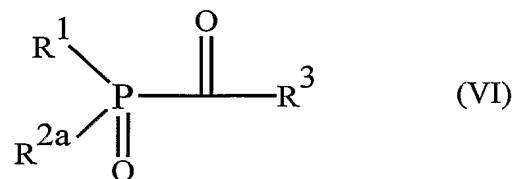
R¹ represents a C₁ - C₁₂ alkyl group, a cyclohexyl group or an aryl group; and

R³ is as defined in Claim 2.

4. A printing ink according to Claim 3, in which each R³ is independently selected from phenyl groups and phenyl groups having from 1 to 4 halogen and/or C₁ - C₆ alkyl and/or C₁ - C₆ alkoxy substituents.

5. A printing ink according to Claim 3 or Claim 4, in which R¹ represents a C₁ - C₁₂ alkyl group or a phenyl group which is unsubstituted or has from 1 to 3 C₁ - C₆ alkyl or alkoxy substituents.

6. A printing ink according to Claim 2, in which said acylphosphine oxide is a compound of formula (VI):

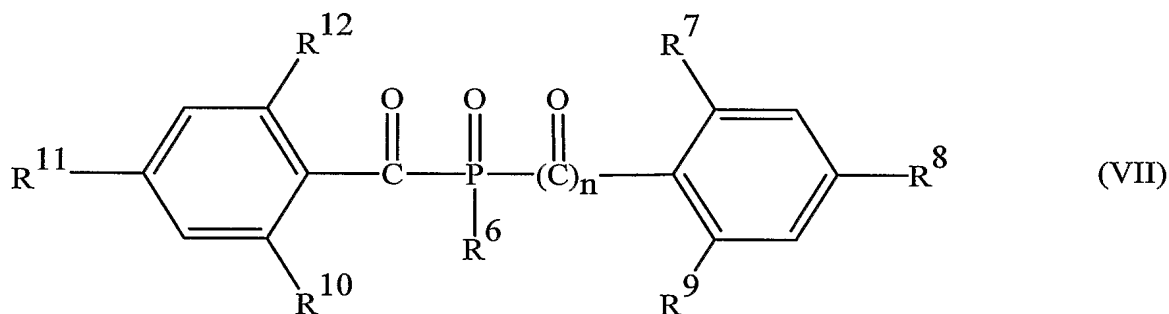


in which:

R^1 and R^3 are as defined in Claim 2; and

R^{2a} represents a $\text{C}_1 - \text{C}_{12}$ alkyl group, a $\text{C}_3 - \text{C}_7$ cycloalkyl group, an aryl group, an aralkyl group, a heterocyclic group having from 3 to 7 ring atoms, of which at least one is a sulphur or nitrogen atom, or a group of formula $-\text{OR}^4$, where R^4 is defined in Claim 2.

7. A printing ink according to Claim 2, in which said acylphosphine oxide is a compound of formula (VII):



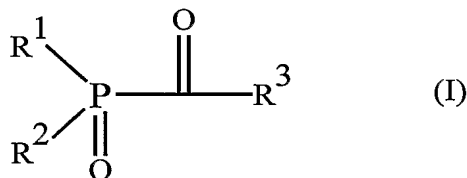
in which:

n is 0 or 1;

R^6 represents a $\text{C}_1 - \text{C}_{12}$ alkyl group, a $\text{C}_1 - \text{C}_6$ alkoxy group, a phenyl group or a phenyl group having from 1 to 4 substituents selected from $\text{C}_1 - \text{C}_6$ alkyl groups, $\text{C}_1 - \text{C}_6$ alkoxy groups and halogen atoms; and

R^7 , R^8 , R^9 , R^{10} , R^{11} and R^{12} are the same as or different from each other and each represents a hydrogen atom, a $C_1 - C_6$ alkyl group, a $C_1 - C_6$ alkoxy group or a halogen atom.

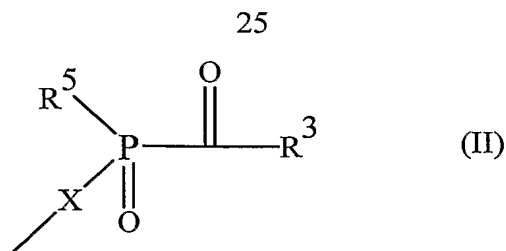
8. A printing ink according to Claim 2, in which said acylphosphine oxide is 2,4,6-trimethylbenzoyl diphenylphosphine oxide, bis(2,4,6-trimethylbenzoyl)phenyl phosphine oxide, ethyl 2,4,6-trimethylbenzoyl diphenylphosphinate or bis(2,6-dimethoxybenzoyl)-2,4,4-trimethylpentylphosphine oxide.
9. A method of producing a document, which comprises intaglio printing on a substrate which does not fluoresce in at least the visible region under ultraviolet light using an intaglio printing ink, curing by free radical acrylate chemistry, and which includes a photoinitiator comprising an acylphosphine oxide, and curing the ink by exposure to a source of radiant energy.
10. A method according to Claim 9, in which said radiant energy is ultraviolet.
11. A method according to Claim 9 or Claim 10, in which said acylphosphine oxide is a compound of formula (I):



in which:

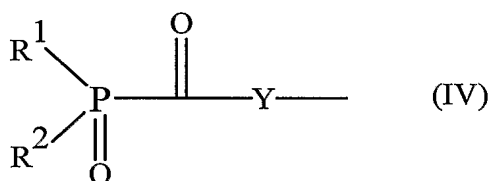
R^1 and R^2 are independently selected from $C_1 - C_{12}$ alkyl groups, $C_3 - C_7$ cycloalkyl groups, aryl groups, aralkyl groups, heterocyclic groups having from 3 to 7 ring atoms, of which at least one is a sulphur or nitrogen atom and groups of formula $-COR^3$;

or R^2 represents a group of formula $-OR^4$, where R^4 represents a $C_1 - C_6$ alkyl group, an aryl group, an aralkyl group or a cationic group or atom, or R^2 represents a group of formula (II):



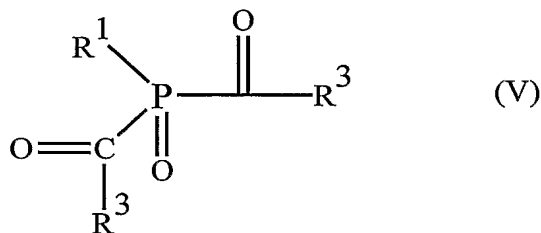
where X represents a C₁ – C₁₈ alkylene group or a biphenyldiyl group, and R⁵ represents any of the groups represented by R¹ or a group of formula –OR⁴; and

R³ represents a C₁ – C₆ alkyl group, an aryl group, a heterocyclic group having from 3 to 7 ring atoms, of which at least one is a sulphur or nitrogen atom, or a group of formula (IV):



where Y represents a C₁ – C₁₈ alkylene group a phenylene group, a cyclohexylene group or a biphenyldiyl group.

12. A method according to Claim 11, in which said acylphosphine oxide is a compound of formula (V):

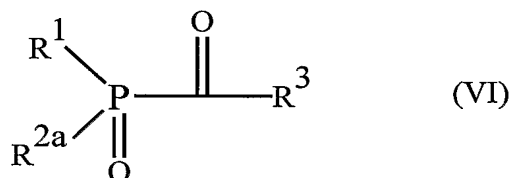


in which:

R¹ represents a C₁ – C₁₂ alkyl group, a cyclohexyl group or an aryl group; and

R³ is as defined in Claim 11.

13. A method according to Claim 12, in which each R^3 is independently selected from phenyl groups and phenyl groups having from 1 to 4 halogen and/or $C_1 - C_6$ alkyl and/or $C_1 - C_6$ alkoxy substituents.
14. A method according to Claim 12 or Claim 13, in which R^1 represents a $C_1 - C_{12}$ alkyl group or a phenyl group which is unsubstituted or has from 1 to 3 $C_1 - C_6$ alkyl or alkoxy substituents.
15. A method according to Claim 11, in which said acylphosphine oxide is a compound of formula (VI):

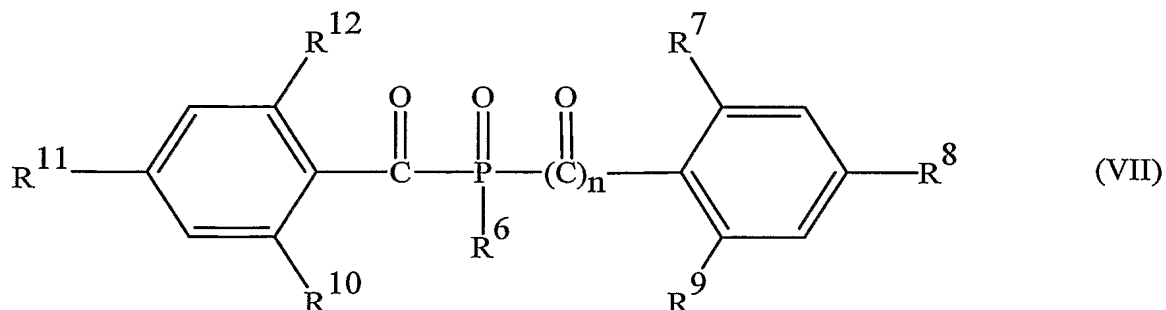


in which:

R^1 and R^3 are as defined in Claim 11; and

R^{2a} represents a $C_1 - C_{12}$ alkyl group, a $C_3 - C_7$ cycloalkyl group, an aryl group, an aralkyl group, a heterocyclic group having from 3 to 7 ring atoms, of which at least one is a sulphur or nitrogen atom, or a group of formula $-OR^4$, where R^4 is defined in Claim 11.

16. A method according to Claim 11, in which said acylphosphine oxide is a compound of formula (VII):



in which:

n is 0 or 1;

R^6 represents a $C_1 - C_{12}$ alkyl group, a $C_1 - C_6$ alkoxy group, a phenyl group or a phenyl group having from 1 to 4 substituents selected from $C_1 - C_6$ alkyl groups, $C_1 - C_6$ alkoxy groups and halogen atoms; and

R^7 , R^8 , R^9 , R^{10} , R^{11} and R^{12} are the same as or different from each other and each represents a hydrogen atom, a $C_1 - C_6$ alkyl group, a $C_1 - C_6$ alkoxy group or a halogen atom.

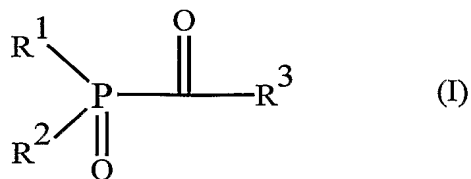
17. A method according to Claim 11, in which said acylphosphine oxide is 2,4,6-trimethylbenzoyl diphenylphosphine oxide, bis(2,4,6-trimethylbenzoyl)phenyl phosphine oxide, ethyl 2,4,6-trimethylbenzoyl diphenylphosphinate or bis(2,6-dimethoxybenzoyl)-2,4,4-trimethylpentylphosphine oxide.

18. A method according to any one of Claims 9 to 17, in which the substrate is a paper.

19. A method according to any one of Claims 9 to 18, in which the document is a security document.

20. A method according to Claim 19, in which the security document is a banknote.

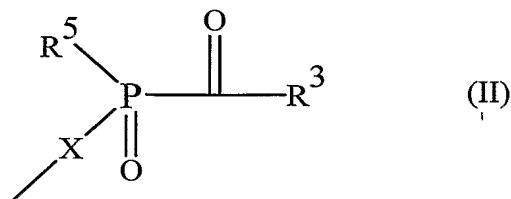
21. The use of an acylphosphine oxide of formula (I):



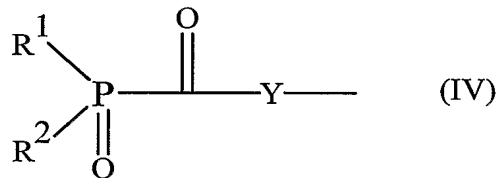
in which:

R^1 and R^2 are independently selected from $C_1 - C_{12}$ alkyl groups, $C_3 - C_7$ cycloalkyl groups, aryl groups, aralkyl groups, heterocyclic groups having from 3 to 7 ring atoms, of which at least one is a sulphur or nitrogen atom and groups of formula $-COR^3$;

or R^2 represents a group of formula $-OR^4$, where R^4 represents a $C_1 - C_6$ alkyl group, an aryl group, an aralkyl group or a cationic group or atom, or R^2 represents a group of formula (II):



where X represents a $C_1 - C_{18}$ alkylene group or a biphenyldiyl group, and R^5 represents any of the groups represented by R^1 or a group of formula $-OR^4$; and R^3 represents a $C_1 - C_6$ alkyl group, an aryl group, a heterocyclic group having from 3 to 7 ring atoms, of which at least one is a sulphur or nitrogen atom, or a group of formula (IV):



where Y represents a $C_1 - C_{18}$ alkylene group a phenylene group, a cyclohexylene group or a biphenyldiyl group.

as a photoinitiator in an energy curable intaglio printing ink to formulate an intaglio printing ink which does not exhibit fluorescence in the visible light wavelength region when exposed to ultraviolet light.